



## NINE OUTPUT 3.3V CLOCK BUFFER

IDT2309NZ

### FEATURES:

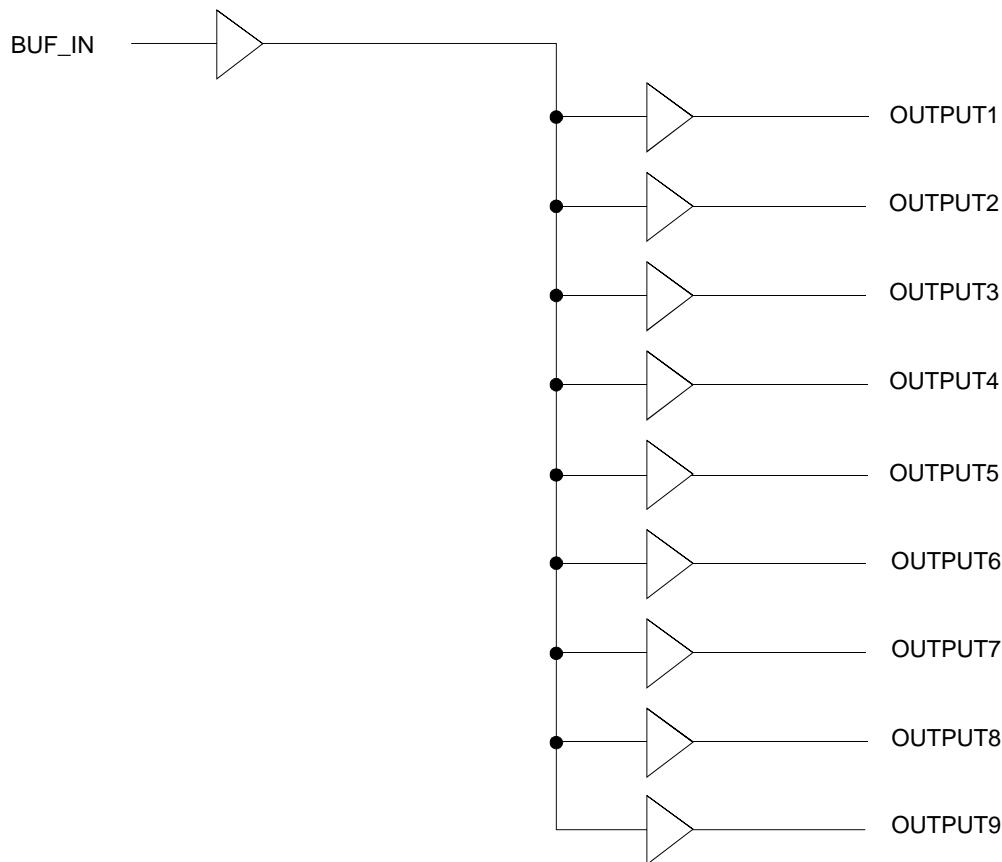
- One input to nine output buffer/driver
- Supports two DIMMs or four SO-DIMMs with one additional output for feedback to an external or chipset PLL
- Low power consumption for mobile applications: less than 32mA at 66.6MHz with unloaded outputs
- 8.7ns input-output delay
- Buffers all frequencies from DC to 133.33MHz
- Output-output skew < 250ps
- Multiple V<sub>DD</sub> and V<sub>SS</sub> pins for noise and EMI reduction
- 3.3V operation
- High drive capability
- Available in SOIC and TSSOP packages

### DESCRIPTION:

The IDT2309NZ is a low-cost buffer designed to distribute high-speed clocks in mobile PC systems and desktop PC systems with SDRAM support. This part has nine outputs, eight of which can be used to drive two DIMMs or four SO-DIMMs, and the remaining can be used for external feedback to a PLL. The IDT2309NZ operates at 3.3V and outputs can run up to 133.33MHz.

The IDT2309NZ is designed for low EMI and power optimization. It has multiple V<sub>DD</sub> and V<sub>SS</sub> pins for noise optimization and consumes less than 32mA at 66.6MHz, making it ideal for the low power requirements of mobile systems.

### FUNCTIONAL BLOCK DIAGRAM

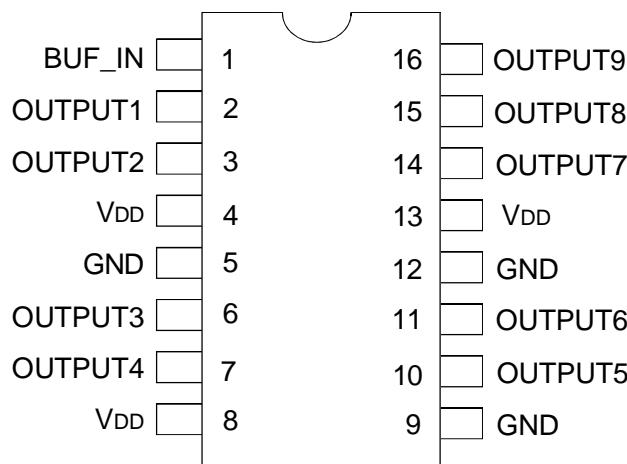


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COMMERCIAL AND INDUSTRIAL TEMPERATURE RANGES

FEBRUARY 2003

## PIN CONFIGURATION



SOIC/ TSSOP  
TOP VIEW

## ABSOLUTE MAXIMUM RATINGS<sup>(1)</sup>

Symbol	Rating	Max.	Unit
V <sub>DD</sub>	Supply Voltage Range	-0.5 to +4.6	V
V <sub>I</sub> <sup>(2)</sup>	Input Voltage Range (REF)	-0.5 to +5.5	V
V <sub>I</sub>	Input Voltage Range (except REF)	-0.5 to V <sub>DD</sub> +0.5	V
I <sub>IK</sub> (V <sub>I</sub> < 0)	Input Clamp Current	-50	mA
I <sub>O</sub> (V <sub>O</sub> = 0 to V <sub>DD</sub> )	Continuous Output Current	±50	mA
V <sub>DD</sub> or GND	Continuous Current	±100	mA
T <sub>A</sub> = 55°C (in still air) <sup>(3)</sup>	Maximum Power Dissipation	0.7	W
T <sub>STG</sub>	Storage Temperature Range	-65 to +150	°C
Operating Temperature Range	Commercial Temperature Range	0 to +70	°C
Operating Temperature Range	Industrial Temperature Range	-40 to +85	°C

### NOTES:

1. Stresses greater than those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.
2. The input and output negative-voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
3. The maximum package power dissipation is calculated using a junction temperature of 150°C and a board trace length of 750 mils.

## PIN DESCRIPTION

Pin Name	Pin Number	Functional Description
V <sub>DD</sub>	4, 8, 13	3.3V Digital Voltage Supply
GND	5, 9, 12	Ground
BUF_IN	1	Input clock
OUTPUT[1:9]	2, 3, 6, 7, 10 11, 14, 15, 16	Outputs

## OPERATING CONDITIONS - COMMERCIAL

Symbol	Parameter	Min.	Max.	Unit
V <sub>DD</sub>	Supply Voltage	3	3.6	V
T <sub>A</sub>	Operating Temperature (Ambient Temperature)	0	70	°C
C <sub>L</sub>	Load Capacitance, F <sub>OUT</sub> < 100MHz	—	30	pF
	Load Capacitance 100MHz < F <sub>OUT</sub> < 133.33MHz	—	15	
C <sub>IN</sub>	Input Capacitance	—	7	pF
BUF_IN, SDRAM[1:9]	Operating Frequency	DC	133.33	MHz

## OPERATING CONDITIONS - INDUSTRIAL

Symbol	Parameter	Min.	Max.	Unit
V <sub>DD</sub>	Supply Voltage	3	3.6	V
T <sub>A</sub>	Operating Temperature (Ambient Temperature)	-40	+85	°C
C <sub>L</sub>	Load Capacitance, F <sub>OUT</sub> < 100MHz	—	30	pF
	Load Capacitance 100MHz < F <sub>OUT</sub> < 133.33MHz	—	15	
C <sub>IN</sub>	Input Capacitance	—	7	pF
BUF_IN, SDRAM[1:9]	Operating Frequency	DC	133.33	MHz

## DC ELECTRICAL CHARACTERISTICS - COMMERCIAL

Symbol	Parameter	Conditions	Min.	Max.	Unit
V <sub>IL</sub>	Input LOW Voltage <sup>(1)</sup>		—	0.8	V
V <sub>IH</sub>	Input HIGH Voltage <sup>(1)</sup>		2	—	V
I <sub>IL</sub>	Input LOW Current	V <sub>IN</sub> = 0V	—	50	μA
I <sub>IH</sub>	Input HIGH Current	V <sub>IN</sub> = V <sub>DD</sub>	—	100	μA
V <sub>OL</sub>	Output LOW Voltage <sup>(2)</sup>	I <sub>OL</sub> = 8mA	—	0.4	V
V <sub>OH</sub>	Output HIGH Voltage <sup>(2)</sup>	I <sub>OH</sub> = -8mA	2.4	—	V
I <sub>DD</sub>	Supply Current	Unloaded Outputs at 66.66MHz	—	32	mA

## NOTES:

1. BUF\_IN input has a threshold voltage of V<sub>DD</sub>/2.
2. Parameter is guaranteed by design but not production tested.

## DC ELECTRICAL CHARACTERISTICS - INDUSTRIAL

Symbol	Parameter	Conditions	Min.	Max.	Unit
V <sub>IL</sub>	Input LOW Voltage <sup>(1)</sup>		—	0.8	V
V <sub>IH</sub>	Input HIGH Voltage <sup>(1)</sup>		2	—	V
I <sub>IL</sub>	Input LOW Current	V <sub>IN</sub> = 0V	—	50	μA
I <sub>IH</sub>	Input HIGH Current	V <sub>IN</sub> = V <sub>DD</sub>	—	100	μA
V <sub>OL</sub>	Output LOW Voltage <sup>(2)</sup>	I <sub>OL</sub> = 8mA	—	0.4	V
V <sub>OH</sub>	Output HIGH Voltage <sup>(2)</sup>	I <sub>OH</sub> = -8mA	2.4	—	V
I <sub>DD</sub>	Supply Current	Unloaded Outputs at 66.66MHz	—	35	mA

## NOTES:

1. BUF\_IN input has a threshold voltage of V<sub>DD</sub>/2.
2. Parameter is guaranteed by design but not production tested.

SWITCHING CHARACTERISTICS - COMMERCIAL<sup>(1)</sup>

Symbol	Parameter <sup>(2)</sup>	Conditions	Min.	Typ.	Max.	Unit
t <sub>3</sub>	Rise Time	Measured between 0.8V and 2V	—	—	1.5	ns
t <sub>4</sub>	Fall Time	Measured between 0.8V and 2V	—	—	1.5	ns
t <sub>5</sub>	Output to Output Skew	All outputs equally loaded	—	—	250	ps
t <sub>6</sub>	Propagation Delay, BUF_IN Rising Edge to OUTPUT Rising Edge	Measured at V <sub>DD</sub> /2	1	5	8.7	ns

## NOTES:

1. All parameters specified with loaded outputs.
2. Parameter is guaranteed by design but not production tested.

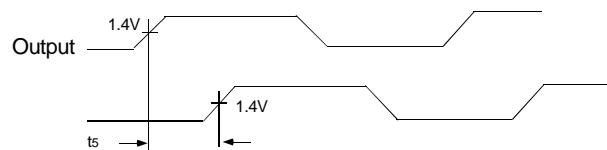
## SWITCHING CHARACTERISTICS - INDUSTRIAL<sup>(1)</sup>

Symbol	Parameter <sup>(2)</sup>	Conditions	Min.	Typ.	Max.	Unit
$t_3$	Rise Time	Measured between 0.8V and 2V	—	—	1.5	ns
$t_4$	Fall Time	Measured between 0.8V and 2V	—	—	1.5	ns
$t_5$	Output to Output Skew	All outputs equally loaded	—	—	250	ps
$t_6$	Propagation Delay, BUF_IN Rising Edge to OUTPUT Rising Edge	Measured at $V_{DD}/2$	1	5	8.7	ns

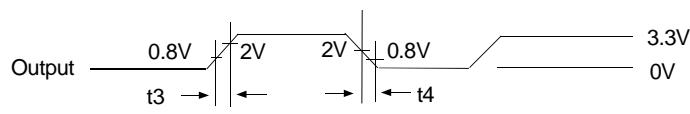
### NOTES:

1. All parameters specified with loaded outputs.
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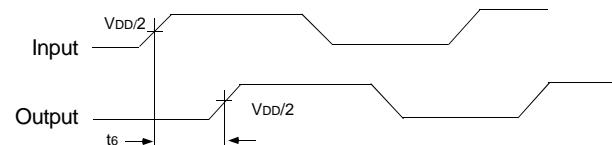
## SWITCHING WAVEFORMS



*Output to Output Skew*

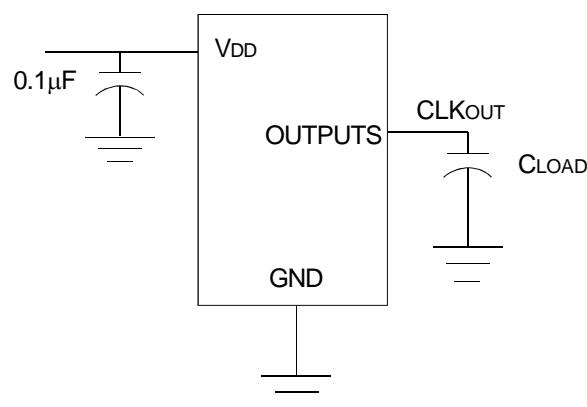


*All Outputs Rise/Fall Time*



*Input to Output Propagation Delay*

## TEST CIRCUIT



## ORDERING INFORMATION

IDT	XXXXX	XX	X		
Device Type	Package	Process			
			Blank	Commercial (0°C to +70°C)	
		I		Industrial (-40°C to +85°C)	
		DC		Small Outline	
		PG		Thin Shrink Small Outline Package	
		PGG		TSSOP - Green	
			2309NZ-1H	Nine Output 3.3V Clock Buffer	



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